

# CLINICAL AND RADIOGRAPHIC EVALUATION OF ONE-PIECE IMPLANTS USED FOR IMMEDIATE FUNCTION

Jack A. Hahn, DDS

This single-center investigation of consecutively placed 1-piece implants reports on treatment outcomes in an ordinary patient pool. Forty-seven implants placed in 30 subjects demonstrated beneficial marginal bone levels and a survival rate of 97.9% after up to 3 years of loading.

**Key Words:** 1-piece root-form implant, NobelDirect implants

## INTRODUCTION

The original Brånemark concept of osseointegration<sup>1,2</sup> advocated a 2-stage surgical procedure. Following placement, the implant was covered by the mucosa and the site was left to heal. A few months later, a second surgical intervention took place involving the placement of an abutment, which penetrated the soft tissue.

Today, implants are often placed in a 1-stage procedure and provided with a prosthetic restoration immediately after implant placement, with high success rates.<sup>3,4</sup> Implant placement in extraction sites—an increasingly popular application for dental implants—may preserve alveolar bone height and width and allow for optimal soft tissue esthetics.<sup>5-7</sup>

A 1-piece design, which incorporates the transmucosal abutment as an integral part of the implant, eliminates the structural weakness built into a 2-piece implant system. Thus, the 1-piece implant can, if it has sufficient mechanical strength, be made with a smaller diameter, accommodating areas with limited bone volume and/or interdental space. Moreover, with a 1-piece implant design, manipulation of the peri-implant soft tissue after initial healing can be avoided. The implant can be provided with a provisional restoration

at placement, allowing for the mucosal epithelium and the connective tissue adhesion to form coronal to the alveolar crest.<sup>8</sup> The preparable abutment portion of the implant makes it possible to create an individualized profile that follows the contour of the gingival margin without violating the soft tissue seal.

My experience with this implant design demonstrated the ease of obtaining primary stability and excellent esthetic results.<sup>9</sup> Because minimally invasive surgery was performed, patients reported little or no discomfort. The initial treatment outcomes for part of the present study population have previously been reported.<sup>10</sup>

The aim of the present research was to evaluate the radiographic outcome of a 1-piece implant when used for immediate function in an ordinary patient pool. This is a preliminary report on outcomes of up to 3 years.

## MATERIAL AND METHODS

In this single-center investigation, 30 subjects were consecutively included based on set inclusion and exclusion criteria. The inclusion criteria included healthy subjects with acceptable oral hygiene planned for implant treatment using a 1-stage procedure with immediate placement of a provisional restoration. No cantilevered restorations were applied. Immediate placement in extraction sockets was not an exclusion criterion.

Forty-seven NobelDirect and NobelPerfect 1-piece implants (Nobel Biocare, Göteborg, Sweden) were

*Jack A. Hahn, DDS, is in private practice in Cincinnati, Ohio. Address correspondence to Dr Hahn at the Cosmetic and Implant Dental Center of Cincinnati, 910 Barry Lane, Cincinnati, OH 45229 (e-mail: CID@iglou.com).*

TABLE 1

## Status of follow-up patients

	Implant and Provisional Prosthesis Placement	1 y	2 y	3 y	Definitive Prosthesis
Number of followed patients	30	24	16	4	27
Number of patients withdrawn	0	1	2	1	1

TABLE 2

## Life table analysis of implants

Time	Number of Implants Placed/Followed	Number of Implants Failed	Number of Implants Withdrawn	No information or Time Not Passed	CSR (%)*
Implant placement–3 mo	47	1	0	1	97.9
3 mo–6 mo	45	0	0	0	97.9
6 mo–12 mo	45	0	0	1	97.9
1 y–2 y	44	0	1	11	97.9
2 y–3 y	32	0	0	23	97.9
3 y	9				

\*CSR indicates cumulative survival rate.

placed in maxillae and mandibles. The implants are machined from a piece of titanium and incorporate the screw-shaped implant body and a fixed abutment in a single component. The screw-shaped implant body for bone anchorage and part of the circular soft tissue penetrating part of the implant have a TiUnite surface. The implants are available in 4 diameters (3.0, 3.5, 4.3, and 5.0 mm) and 4 lengths (10, 13, 15, and 16 mm).

Of the 47 implants, 30 were placed in maxillae and 17 in mandibles. The implants were evenly distributed in the posterior maxilla (30%), posterior mandible

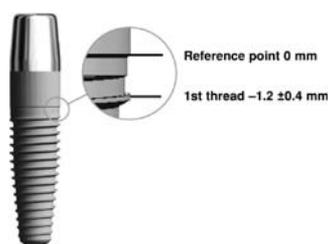
(32%), and anterior maxilla (34%); only 4% of the implants were placed in the anterior mandible.

The implants were placed according to the instructions from the manufacturer. The surgical techniques included both flapless placement and placement after flap elevation. The provisional restorations were made according to general practice and placed out of occlusion or in light central occlusion. Replacement of provisional restorations with definitive prosthetic restorations was carried out on an individual basis.

Intraoral radiographs were obtained at the 1-, 2-, and 3-year follow-ups and were examined by an independent radiologist.

TABLE 3

## Marginal bone level (in relation to reference point) over time



Bone Level (mm)	1 y		2 y		3 y	
	N	%	N	%	N	%
>0	9	28	10	38	1	13
0	2	6	0	0	1	13
-0.1 to -1.0	8	24	7	27	5	61
-1.1 to -2.0	12	36	8	31	1	13
-2.1 to -3.0	0	0	0	0	0	0
<-3.0	2	6	1	4	0	0

## RESULTS

Twenty-four patients (80%) attended the 1-year follow-up visit. Sixteen (53%) and 4 (13%) patients attended the 2- and 3-year follow-up visits, respectively. Definitive prosthetic restorations were delivered to 27 patients. The follow-up status of patients and the life table analysis of implants are presented in Tables 1 and 2. One patient, who moved following the 1-year follow-up visit, was withdrawn from the study. One maxillary implant (16-mm-long NobelDirect) was lost prior to the 3-month visit, resulting in a survival rate of 97.9% after up to 2 years of loading.

Intraoral preparation at the time of implant placement to achieve interarch clearance was done for 16 implants. The preparation lasted up to 5 minutes per implant, with the exception of 2 implants whose preparation lasted 1 minute each. The implants were placed after raising a flap or making an incision

with a tissue punch. Eighteen implants were placed in extraction sockets immediately after tooth extraction, without raising a flap. Local bone grafting was performed around 74% of the implants. All implants were immediately provided with a provisional restoration. Thirty-six percent of the implants were out of occlusion and 17% were placed in light central occlusion.

The apical corner of the cylindrical transmucosal part of the implant was used as a reference point for the radiologic evaluation. The mean marginal bone levels were as follows:  $-0.78$  mm (SD 1.60,  $n = 33$ ) at 1 year,  $-0.26$  mm (SD 1.50,  $n = 26$ ) at 2 years, and  $-0.54$  mm (SD 0.51,  $n = 8$ ) at 3 years, relative to the reference point (Table 3).

## DISCUSSION

In this study 1 of the 47 implants had to be removed, resulting in a cumulative implant survival rate of 97.9% throughout the follow-up period. The clinical and radiologic outcome of one case are illustrated in Figures 1 through 4.

The mean marginal bone level relative to the reference point after 1 year of loading ( $-0.78 \pm 1.60$  mm), as well as after 2 and 3 years of loading, was located above the first implant thread. This is in accordance with, or better than, previously reported results from studies that investigated 2-piece implant designs.<sup>11-13</sup> In this study, a bone level  $>2$  mm apical to the reference point after 1 year of loading was observed at 2 implants (6%). This is a lower percentage than the



FIGURES 1-4. FIGURE 1. X-ray obtained at the time of implant placement. FIGURE 2. Healed soft tissue with restoration in place. FIGURE 3. X-ray at 2 years after implant placement. FIGURE 4. An implant replaced a maxillary lateral incisor.

16% reported for 2-piece implants.<sup>14</sup> The 1-piece implant design enables undisturbed healing of the peri-implant soft tissue and avoids disruption of the soft tissue seal when placing the definitive prosthetic restoration. This design benefit of the implant may be one reason for the favorable mean marginal bone level demonstrated after 1 year of functional loading.

The flapless surgical technique used for some of the implants may also have contributed to the beneficial marginal bone level outcome. Avoiding separation of the periosteum from the underlying tissue may result in a better-maintained blood supply to the marginal bone, thus reducing the likelihood of bone resorption.

### CONCLUSION

The 1-piece implant design resulted in a high cumulative implant survival rate and beneficial marginal bone levels. This implant design offers an attractive and easy alternative to 2-piece implants for treatment with immediate provisional restorations.

### NOTE

The author has a clinical consulting agreement with Nobel Biocare for ongoing clinical studies and continuing education courses.

### REFERENCES

1. Brånemark P-I, Zarb GA, Albrektsson T, eds. *Tissue-Integrated Prostheses: Osseointegration in Clinical Dentistry*. Chicago, Ill: Quintessence; 1985:11–76.
2. Albrektsson T, Brånemark P-I, Hansson H, Lundström J. Osseointegrated titanium implants. Requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. *Acta Orthop Scand*. 1981;52:155–170.
3. Schnitman PA, Wohrle PS, Rubenstein JE, DaSilva JD, Wang NH. Ten-year results for Brånemark implants immediately loaded with fixed prostheses at implant placement. *Int J Oral Maxillofac Implants*. 1997;12:495–503.
4. Tarnow DP, Emtiaz Classi A. Immediate loading of threaded implants at stage 1 surgery in edentulous arches: ten consecutive case reports with 1- to 5-year data. *Int J Oral Maxillofac Implants*. 1997;12:319–324.
5. Becker W, Ricci A, Geurs N. A prospective clinical trial of endosseous screw-shaped implants placed at the time of tooth extraction without augmentation. *J Periodontol*. 1998;69:920–926.
6. Becker W, Dahlin C, Lekholm U, et al. Five-year evaluation of implants placed at extraction and with dehiscences and fenestration defects augmented with ePTFE membranes: results from a prospective multicenter study. *Clin Implant Dent Relat Res*. 1999;1:27–32.
7. Lazzara RJ. Immediate implant placement into extraction sites: surgical and restorative advantages. *Int J Periodontics Restorative Dent*. 1989;9:332–343.
8. Drago CJ. Clinical and histological assessment of a one-piece implant system: a pilot study. *Dent Praxis*. 2005;11/12:319–325.
9. Hahn J. One-piece root-form implants: a return to simplicity. *J Oral Implantol*. 2005;2:77–84.
10. Hahn J. Clinical evaluation of one-piece implants used for immediate function. A preliminary report of bone level up to 2-year. *Eur J Dent Implantol*. 2006;2(suppl 1):12–15.
11. Jemt T. Fixed implant-supported prostheses in the edentulous maxilla. A five-year follow-up report. *Clin Oral Implants Res*. 1994;5:142–147.
12. Vanden Bogaerde L, Pedretti G, Dellacasa P, Mozzati M, Rangert B. Early function of splinted implants in maxillas and posterior mandibles using Brånemark System, machined-surface implants: an 18-months prospective clinical multicenter study. *Clin Implant Dent Relat Res*. 2003;5(suppl 1):21–28.
13. Widmark G, Friberg B, Johansson B, Sindet-Pedersen S, Taylor Å. MkIII: a third generation of the self-tapping Brånemark system implant, including the new Stargrip design. A 1-year prospective four-center study. *Clin Implant Dent Relat Res*. 2003;5:273–279.
14. Glauser R, Ruhstaller P, Windisch S, et al. Immediate occlusal loading of Brånemark System TiUnite implants placed predominantly in soft bone: 4-year results of a prospective, clinical study. *Clin Implant Dent Relat Res*. 2005;7(suppl 1):52–59.